CLAIMS

1. Process for preparing cyclohexanone oxime, said process comprising:
in a cyclohexanone oxime synthesis zone, reacting hydroxylammonium with cyclohexanone to form cyclohexanone oxime;
distilling an organic solution comprising cyclohexanone oxime, cyclohexanone and an organic solvent to obtain (i) a first product comprising organic solvent, (ii) a second product comprising cyclohexanone and (iii) a third product comprising cyclohexanone oxime; and
feeding the second product into said cyclohexanone oxime synthesis zone.

2. Process according to claim 1, wherein the process further comprises:
countercurrently contacting an aqueous medium with an organic medium in said cyclohexanone oxime synthesis zone, said aqueous medium containing hydroxylammonium, said organic medium comprising cyclohexanone;
feeding organic solvent into said cyclohexanone oxime synthesis zone at a feeding level for organic solvent; and
feeding said second product into said cyclohexanone oxime synthesis zone at a level downstream of the feeding level for organic solvent (seen in the direction of flow of the organic medium).

3. Process according to claim 2, wherein the process further comprises:
feeding cyclohexanone into the cyclohexanone oxime synthesis zone at a feeding level for cyclohexanone, said feeding level for cyclohexanone being downstream of the feeding level for organic solvent (seen in the direction of flow of the organic medium); and
feeding said second product into the cyclohexanone oxime synthesis zone at said feeding level for cyclohexanone or downstream of the feeding level for cyclohexanone (seen in the direction of flow of the organic medium).

4. Process according to claim 2 or claim 3, wherein the process further comprises discharging an organic product solution which comprises cyclohexanone oxime and organic solvent from said cyclohexanone oxime synthesis zone at a discharge level for organic product solution, said discharge level for organic product solution being downstream of the feeding level for cyclohexanone (seen in the direction of flow of the organic medium).

5. Process according to claim 4, wherein the process further comprises feeding the second product upstream of the discharge level for organic product

solution (seen in the direction of flow of the organic medium).

6. Process according to claim 4 or claim 5, wherein the aqueous medium and organic medium present between the feeding level for cyclohexanone and the discharge level for organic product solution have a sum volume of V, and wherein the process comprises feeding the second product into the cyclohexanone oxime synthesis zone at a level such that the aqueous medium and the organic medium present between the feeding level for cyclohexanone and the level at which the second product is fed into cyclohexanone oxime synthesis zone have a sum volume of at least V/10.

7. Process according to any one of claims 4 to 6, wherein the process further comprises:
countercurrently contacting the aqueous medium and the organic medium present between the feeding level for cyclohexanone and the discharge level for organic product solution in a column or in series-connected columns, said column or said series-connected columns having a total column length L; and
feeding the second product into said column or series-connected columns at a distance of at least L/10 measured from said feeding level for cyclohexanone.

8. Process according to any one of claims 4 to 6, wherein the process further comprises:
countercurrently contacting the aqueous medium and the organic medium present between the feeding level for cyclohexanone and the discharge level for organic product solution in a number of series-connected mixer-settlers; and
feeding the second product into the second or higher-numbered mixer-settler counted from the feeding level for cyclohexanone.

9. Process according to any one of claims 4 to 8, wherein said organic product solution is said organic solution.

10. Process according to any one of claims 1 to 9, wherein the process comprises feeding the second product into the cyclohexanone oxime synthesis zone such that the sum concentration of cyclohexanone and cyclohexanone oxime in the aqueous medium leaving the cyclohexanone oxime synthesis zone is less than 20,000 ppm (2 wt.%), preferably less than 5,000 ppm (0.5 wt.%), more preferably less than 1,000 ppm (0.1 wt.%), more preferably less than 500 ppm (0.05 wt.%), more preferably less than 200 ppm (0.02 wt.%).

11. Process according to any one of claims 2 to 10, wherein said feeding of

organic solvent into the cyclohexanone oxime synthesis zone at the feeding level for organic solvent is effected by feeding the first product into the cyclohexanone oxime synthesis zone at the feeding level for organic solvent.

12. Process according to any one of claims 1 to 11, wherein said second product contains cyclohexanone oxime.

13. Process according to any one of claims 1 to 12, wherein the weight ratio cyclohexanone oxime/cyclohexanone in the second product is higher than 0.1, preferably higher than 0.2, more preferably higher than 0.3, in particular higher than 0.4, more in particular higher than 0.5.

14. Process according to any one of claims 1 to 13, wherein the process comprises distilling the organic solution to obtain the first product as a distillate; distilling the remaining bottom product to obtain the second product as a distillate and the third product as a bottom product.

15. Process according to any one of claims 1 to 14, wherein the process comprises withdrawing said organic solution from the cyclohexanone oxime synthesis zone.

16. Process according to any one of claims 1 to 15, wherein the ratio $f_h/f_c < 1.00$, more preferably < 0.99, more preferably less than 0.98, wherein f_h represents the molar quantity of hydroxylammonium fed to the cyclohexanone oxime synthesis zone per unit of time (in mol/s), and f_c represents the molar quantity of cyclohexanone fed to the cyclohexanone oxime synthesis zone per unit of time (in mol/s).

17. Process according to any one of claims 1 to 16, wherein the organic solvent is selected from the group consisting of benzene, toluene, xylene, methylcyclopentane, cyclohexane and mixtures thereof.

18. Process according to claim 17, wherein the organic solvent is toluene.

19. Process according to any one of claims 1 to 18, wherein the aqueous medium is an acidic medium buffered with phosphate.